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ABSTRACT

The growing evidence of the link between diet and health has not been lost on consumers in the United States. As awareness of the diet-health link has increased through nutrition education, consumers have changed their diets. Although there is still considerable room for improvement in meeting Federal food-guidance recommendations, nutrition concerns have become an important factor in food choices. Both the food sector and the Federal Government have responded to consumer concerns about nutrition through improvements in the nutrient profile of food products, improved information on food labels, and nutrition education program such as "5 A Day For Better Health", aimed at increasing consumption of fruits and vegetables. Technological advances in food processing have given the food industry new tools that are likely to accelerate the introduction of tasty healthier foods. Changes in what, where, and how food products are produced present unlimited opportunities for domestic and foreign producers and food manufacturers who can identify, respond to, or create new consumer food desires. The topics covered are: Diet and health guidance; awareness of the linkage between diet and health; trends in food consumption; intake levels and dietary guidelines; changes in food consumption patterns, 1977-1988; responses of both the food sector and the government; and likely impacts on agriculture. An appendix provides the main sources of information. (Contains 42 references.) (Author/JB)

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United States Department of Agriculture

Economic Research Service

Agriculture Information Bulletin Number 705

Consumer Concerns About Nutrition

Opportunities for the Food Sector

Elizabeth Frazão

U.S. DEPARTMENT OF EDUCATION
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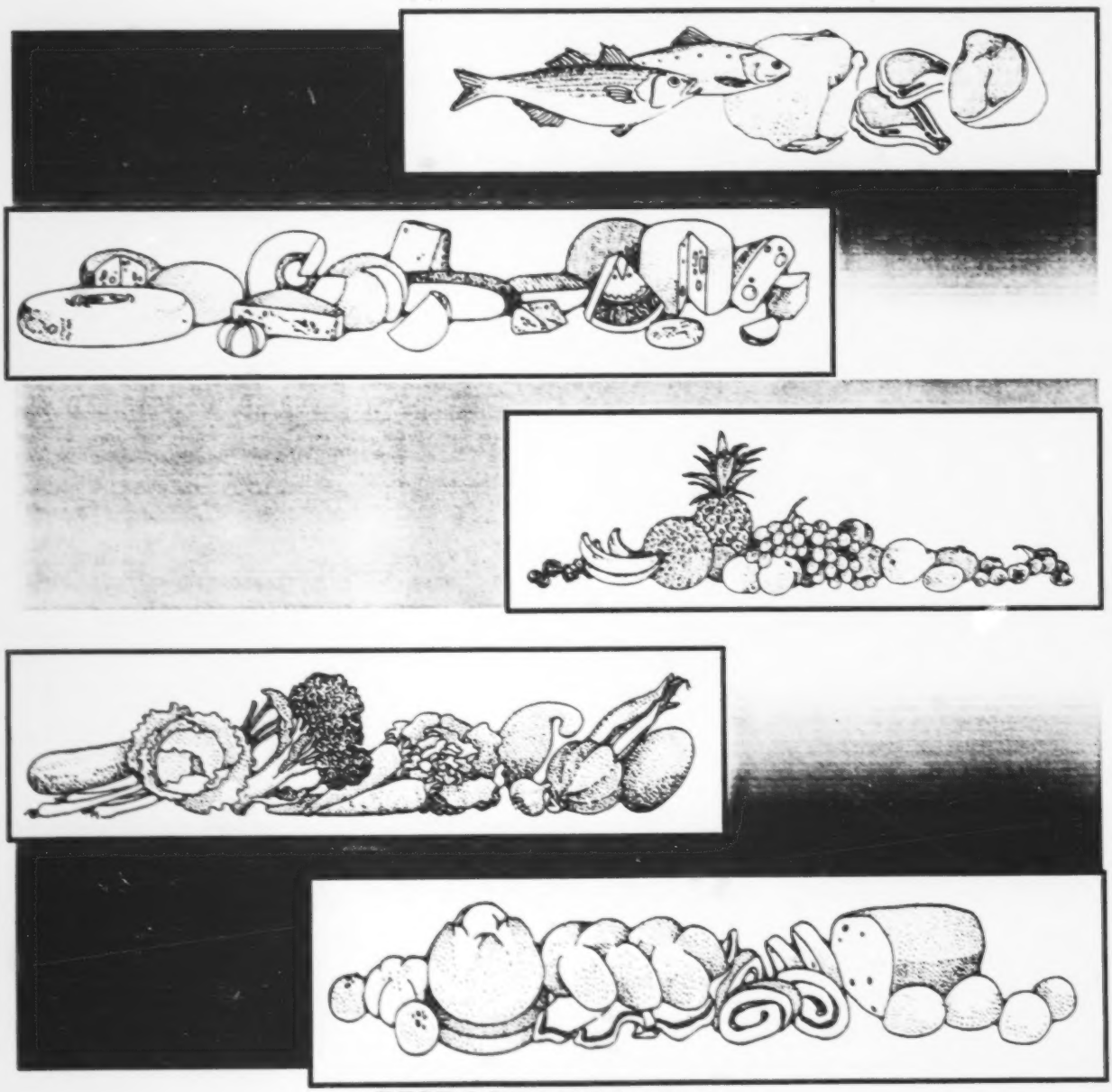

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Consumer Concerns About Nutrition: Opportunities for the Food Sector. By Elizabeth Frazão, Commodity Economics Division, Economic Research Service, U.S. Department of Agriculture. Agriculture Information Bulletin No. 705.

Abstract

The growing evidence of the link between diet and health has not been lost among consumers in the United States. As awareness of the diet-health link has increased, consumers have changed their diets. Although there is still considerable room for improvement in meeting Federal food-guidance recommendations, nutrition concerns have become an important factor in food choices. Both the food sector and the Federal Government have responded to consumer concerns about nutrition through improvements in the nutrient profile of food products and improved information on food labels. Technological advances in food processing have given the food industry new tools that are likely to accelerate the introduction of tasty healthier foods. Changes in what, where, and how food products are produced present unlimited opportunities for domestic and foreign producers and food manufacturers who can identify, respond to, or create new consumer food desires.

Keywords: Nutrition, diet-health awareness, food consumption patterns, nutrition labeling, new food products, food marketing, food manufacturing.

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Summary

As evidence of the link between diet and health grows in the United States, many consumers are changing their diets. Food consumption patterns have changed dramatically in the last 20 years. Eating patterns are slowly shifting toward healthier diets, although there is still considerable room for improvement in meeting Federal food guidance recommendations. The food sector is clearly aware that nutrition is important to many consumers, and has been active in responding to consumer demand for foods with improved nutrient profiles. Meats, for example, are much leaner now than even 10 years ago, due to improved breeding practices and changes in meat-trimming practices.

Many consumers want to improve their diets, but claim they lack the information to do so. Research has shown that many of the changes Americans have made in their food choices end up canceling each other out. To assist consumers in choosing a healthier diet, the Federal Government has overhauled its nutrition labeling regulations. In mid-1994, new nutrition labels became mandatory for most processed foods. Although nutrition labeling remains voluntary for fresh produce, meats, and seafood, the regulations contain strong incentives for the information to be made available to consumers.

New or reformulated products have also abounded. More than 4,500 claims were made about the improved nutrient content of new foods in 1992--nearly four times the number made in 1988. The number of nutrient content claims on new products fell significantly in 1993, possibly related to the new mandatory nutrition labeling regulations. These regulations may push manufacturers to reformulate their products to further improve their nutrient content to meet the new definitions and requirements for health claims and nutrient descriptors.

Although Americans are making some dietary changes, they enjoy the taste of high-fat foods and do not seem willing to give them all up. If food companies can develop lower fat products that taste like traditional high-fat foods, and provide consumers with acceptable low-fat substitutes, the food industry can help consumers to eat less fat without having to greatly change their eating habits.

Advances in food technology are likely to accelerate the introduction of nutritious foods that taste good. Continued research and product development that alter the nutritional composition of the food supply should help improve nutrient intake levels in the United States.

The success of new research and technology in improving the nutritional composition of Americans' diets, however depends on a number of factors. First, Federal regulators must approve the safety of novel ingredients and their use in food, a process that can often be quite lengthy. Consumer acceptance of the new technology, as well as price, will also affect how well the new products sell in the market.

Grocers have also responded to consumers' nutrition concerns and are giving more space and attention to the fresh produce section. Today's medium-sized supermarket carries more than 300 produce items. To reduce the time requirement of preparing fresh fruits and vegetables, the produce department has introduced a variety of precut and ready-to-eat fresh products, such as peeled and cut carrots, salad mixes, and peeled and cored pineapples.

Nutrition education is another area in which the food sector has become actively involved in response to consumers' nutrition concerns. An example of such a program is "5 a Day for Better Health," an active partnership between the National Cancer

Institute, the produce industry, and the health community, aimed at increasing consumption of fruits and vegetables.

Food advertising and labeling can be powerful mechanisms for educating consumers and informing groups of consumers that are not well reached by government and general information sources. Whereas advertising and label claims can provide consumers with more information about nutrition, they can also be misused as manufacturers fight to gain a competitive edge for their products. The new nutrition labeling regulations attempt to minimize the amount of misleading information on food labels.

Increasing consumer demand for tasty and nutritious foods is likely to change what, where, and how food products are produced, presenting unlimited opportunities for domestic and foreign food producers and manufacturers who can identify, respond to, or create new consumer food desires.

Consumer Concerns About Nutrition
Opportunities for the Food Sector

Elizabeth Frazão

Introduction

Today's rapidly changing economic and social environment provides many challenges to food producers and manufacturers all around the world. While day-to-day survival is of paramount importance to firms operating in this dynamic arena, longrun survival and financial well-being require that the players understand and successfully anticipate consumers' food desires in the years to come.

Slower population growth, changing age distributions, regional migration, increased longevity, employment patterns, and increasing standards of living, to name just a few significant demographic trends, present an ever-changing and uncertain environment within which the food sector must operate and respond. Significant research has focused on explaining the effects of these variables and forecasting their effects on food demand.

Two new factors are emerging as important considerations in consumers' food choices. The first is food safety. This includes concerns about pesticide and herbicide residues; antibiotics and hormones in poultry, meat, and dairy products; irradiation; microbial contamination; and environmental contamination from heavy metals such as mercury. Rising standards of living, an aging population (which tends to be at higher risk of foodborne illness), and the fact that demand for food safety appears to be income-sensitive are some of the forces likely to enlarge the market for food safety in the future.

In the past 10 years or so, food safety incidents have occurred fairly regularly in the United States. The costs associated with food safety incidents are borne not only by the consumers who suffer health consequences, but by farmers, processors, and retailers, in terms of lost production and loss of consumer confidence in their product. Both the food sector and the Government in the United States are taking aggressive steps to improve both the safety of food products and consumer understanding about the safety of the food supply.

In addition, a segment of the food sector has discovered new marketing opportunities by differentiating and advertising the food safety attributes of its products. For example, the market for "organic" foods--foods produced without synthetic fertilizers or chemicals--is growing. Among new food products introduced in 1992, organic claims represented more than 7 percent of the health claims (*Prepared Foods*). Besides fruits and vegetables, consumers can buy organically produced grains, meats, dairy products, and a wide variety of processed products, including breakfast cereals, baked goods, juices, wine, and coffee (Anton and Frazão, 1993).

The second new factor influencing food choices, and the one this report focuses on, is the growing evidence of the relationship between diet and diseases such as coronary heart disease, certain types of cancer, stroke, and hypertension (U.S. Department of Health and Human Services, 1988; National Research Council, 1989). To the extent that consumers act on the belief that what they eat can influence their health, awareness of the linkage between diet and health and knowledge about nutrition may play a significant role in shaping the foods of tomorrow. Yet very little is known about the role that nutritional concerns have on food consumption patterns and on the food sector in general.

Some information is beginning to emerge in the United States that may be useful to food producers and manufacturers throughout the world. First, trends currently observed in the United States may soon occur in other countries. In fact, even in some countries where insufficient food intake represents a serious nutrition problem, the problem of excessive intake of calories and fat is already becoming evident among some segments of the population. Second, today's trends in the United States may provide foreign producers and manufacturers who export, or desire to export, food into the United States with opportunities to fill a gap not met by the domestic food sector.

Diet and Health Guidance in the United States

Over the past three decades, research findings on diet-health relationships have received considerable attention in the United States and have generated much public interest. Government and private organizations have responded to the emergence of scientific knowledge by issuing dietary guidance and making recommendations on desired dietary changes for the U.S. population.

The idea behind disseminating information to the public is that by providing consumers information about the linkage between diet and health, and what a healthy diet should consist of, consumers become aware of the issue and will want to alter their diets to reduce the risk of chronic disease. This desire to improve their diets will then motivate consumers to get more information, alter their food choices and preparation techniques, and ultimately change their total diets to meet recommended nutrient levels.

With the objective of informing the public, the Federal Government publishes and distributes "The Dietary Guidelines for Americans" (U.S. Department of Agriculture/U.S. Department of Health and Human Services, 1990). Although there is still much that is not known about all the linkages between diet and health, nutrition authorities in the United States have agreed to a remarkable degree on what to eat and what not to eat to help prevent disorders such as obesity, coronary heart disease, and cancer. Thus, the latest Dietary Guidelines recommend that consumers:

- Eat a variety of foods
- Maintain healthy weight
- Choose a diet low in fat, saturated fat, and cholesterol (keep fat intake at 30 percent or less of calories, and saturated fat below 10 percent)
- Choose a diet with plenty of vegetables, fruits, and grain products
- Use sugars only in moderation
- Use salt and sodium only in moderation
- Drink alcoholic beverages in moderation, if at all

To help consumers put the guidelines into practice, the U.S. Department of Agriculture (USDA) also developed a food guide, which separates foods into six food groups and recommends the number of servings from each food group for a healthy diet. To graphically illustrate the food guide, USDA developed the *Food Guide Pyramid* (U.S. Department of Agriculture, Human Nutrition Information Service, 1992), which recommends, on a daily basis:

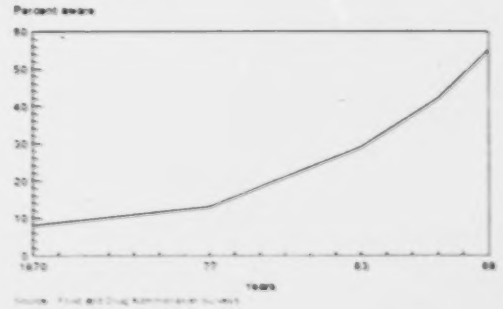
- 6-11 servings of grains and cereals
- 3-5 servings of vegetables
- 2-4 servings of fruits
- 2-3 servings of milk and dairy products
- 2-3 servings of meat, poultry, fish, eggs, beans, and nuts (averaging about 6 oz per day)
- sparing use of fats, oils, and sweets

The Food Guide Pyramid attempts to improve consumers' eating patterns in two ways. First, it tries to change consumers' perceptions about the relative quantities of each food group in a healthy diet. Many Americans still believe, for example, that "starchy foods are fattening" and therefore should be consumed sparingly. Second, the Food Guide Pyramid attempts to overcome an important barrier to effective nutrition education, wherein some of the Dietary Guidelines deal with nutrients (for example, "choose a diet low in fat"), but consumers choose and consume foods, not nutrients. Consumers have difficulties translating advice about nutrient intake into food consumption behavior and need more practical advice (Food Marketing Institute, 1991, 1992, 1993).

Awareness of the Linkage Between Diet and Health

Investigators have historically measured consumer awareness of the linkages between diet and health by the percentage of persons who, when questioned, say that dietary fats and fatty foods are a major cause of heart disease. Data from the Health and Diet Surveys that the Food and Drug Administration (FDA) conducted indicate that, by this measure, awareness levels have greatly increased over time, rising from 8 percent in 1970, and 29 percent in 1983, to reach 55 percent in 1988 (fig. 1).

Figure 1
Consumer awareness of the link between fat intake and heart disease has increased dramatically

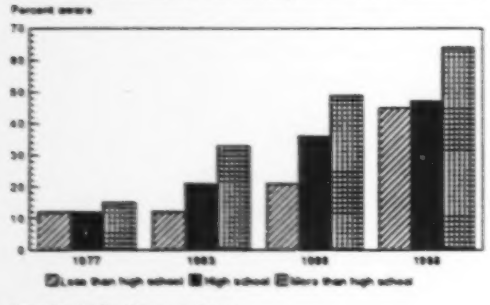


Although all segments of society have shown increases in awareness through time, the levels of awareness vary for different groups. Comparing awareness levels for different education groups at four different points in time, we note that, on average, individuals with higher education levels became aware of the link between fat intake and heart disease before those with less education (fig. 2). Although there was little difference in awareness levels across education groups in 1977, by 1983, these differences were clearly evident. And although awareness more than doubled between 1983 and 1988 for high school-educated adults, and more than tripled among adults with less than a high school education, awareness levels remained higher among higher educated adults.

This growing awareness is associated with consumer concerns about nutrition, which is reflected in a number of consumer surveys. In response to open-ended, unguided questions in a 1993 survey conducted by the Food Marketing Institute, 54 percent of the respondents reported being concerned about the fat content of their diets. And two out of three shoppers believed their diet could be at least somewhat healthier. The explosion of "light" and "healthy" food products in the last decade is further indication of increased consumer awareness and interest in nutrition.

A large proportion of consumers stated that they have made changes, and are still changing their eating habits, due to interest in having a healthier diet. Many report frying foods less often and switching to reduced-fat mayonnaise and salad dressing in an effort to improve the healthfulness of their diet (Food Marketing Institute and *Prevention Magazine*, 1992). In a 1993 survey, 62 percent of the respondents reported eating more fruits and vegetables to ensure a healthy diet; 30 percent, less red meat; 26 percent, less fats and oils; 14 percent, more chicken and turkey; and 10 percent, more fish (Food Marketing Institute, 1993).

Figure 2
Consumer awareness of the link between fat intake and heart disease has increased dramatically for all education levels.



Source: Food and Drug Administration Surveys

To quantify the extent of changes in consumption of different food groups, we examine: (1) how eating patterns in the United States have been changing over time; (2) how current intake levels compare with the Dietary Guidelines; and (3) how eating patterns vary across groups of individuals with different awareness levels. The main sources of data used in this analysis are described in the appendix.

Trends in Food Consumption

Americans' eating habits have changed dramatically in the last 20 years. Although Americans are consuming more food (by weight) than ever, eating patterns seem to be shifting toward healthier diets (Putnam, 1991). However, some changes have been slower than others, and many have even been inconsistent with dietary recommendations.

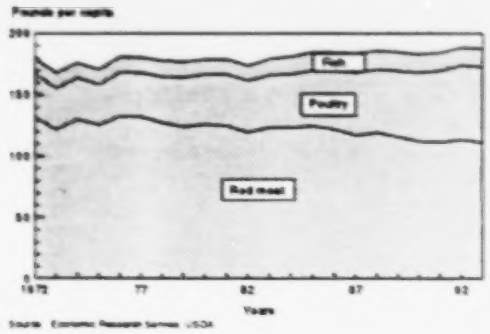
Animal products are a regular part of the diets of most Americans. When consumed in recommended amounts, they can provide important amounts of several essential nutrients (such as iron and calcium), without resulting in excessive intakes of fat, saturated fat, and cholesterol (Guthrie and Raper, 1992). In the past two decades, the amounts and types of animal products in the American diet have changed considerably, as described below.

Meat

Total per capita consumption of meat continues to increase (fig. 3), but the proportion of red meat consumption has been declining while poultry and fish consumption has increased (Putnam and Allshouse, 1993). However, both pork and beef are leaner now compared with 10 years ago. Some of the improvements in fat content result from changes in breeding practices (fig. 4), and some result from changes in meat-trimming practices. Beef today is trimmed to 1/4-inch or less of outside fat, and more than 40 percent of retail beef cuts are marketed with all the outside fat removed (Putnam, 1993). On average, meats represent a large but decreasing contributor to dietary fat, although they are large contributors of iron and other essential nutrients (Guthrie and Raper, 1992).

The increase in fish consumption is not as large as one would expect, given its "healthy" characteristics. Price and the frequent negative reports on its safety may have caused some consumers to eat less seafood.

Figure 5
Consumption of all meats is up, but the mix is changing



Source: Economic Research Service, USDA

These trends support consumers' statements that they are cutting back on red meat and increasing their consumption of poultry and fish to ensure a healthier diet.

Dairy Products

As with meats, per capita consumption of all dairy products continues to increase (on a milk-equivalent, milkfat basis), although the mixture is changing. The trend is toward lower fat milk, but more cheese (Putnam and Allshouse, 1993). In the past 10 years, whole milk went from representing nearly 60 percent of all beverage milk to 40 percent (fig. 5). Evidence of this trend is McDonald's switch from whole milk to 2-percent milk in 1986, and from 2-percent to 1-percent milk in 1991. Many food service operators now provide whole milk or 2-percent milk, instead of cream, as coffee whiteners. Schools remain a large market for whole milk, an offering in the federally funded National School Lunch Program (Putnam, 1993).

Consumption of cheese continues to increase (fig. 6), partly because of the growth in fast food away from home (two-thirds of the cheese consumed comes in commercially manufactured and prepared foods, such as pizza, nachos, and fast food sandwiches), and partly because consumers are not usually aware of the high fat content of cheese. With advances in food technology, lower fat cheeses have entered the market, but they currently account for only about 5 percent of total cheese consumption (Putnam, 1993). Because of this growing demand for cheese (and also cream and cream products), overall use of milkfat has not declined significantly (Putnam and Allshouse, 1993). It will be interesting to see whether the new nutrition labeling regulations (which became effective in mid-1994, and which are discussed later) will increase consumer awareness about the high fat content of cheese and subsequently reduce demand for high-fat cheese.

Eggs

Average annual consumption of fresh eggs continues to decline overall (fig. 7), largely due to consumer concerns about the high cholesterol content of eggs. But within this decline, consumption of some egg products rose, due to improved food technology and the food industry's ability to respond to new consumer demands. For example, more low-cholesterol, commercially processed egg products are available to health-conscious consumers concerned with avoiding the cholesterol and fat in egg yolks. Similarly, availability of pasteurized liquefied eggs has increased for consumers and food service companies concerned about food-borne illnesses such as *Salmonella enteritidis* (Putnam, 1993).

Fats and Oils

Data on fats and oils report the availability of manufactured products such as shortening, margarine, and salad and cooking oils, but do not include the fats and oils that occur naturally in food, such as in meats, milk and milk products, and nuts.

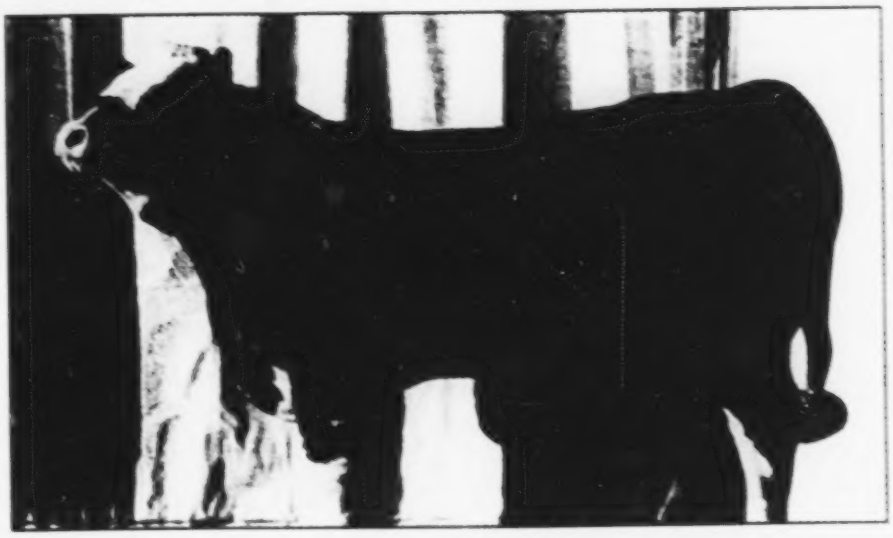
Despite consumers' concerns about fat intake, and their claims about eating less fats and oils, the aggregate amount of manufactured fats and oils available for consumption continues to increase (fig. 8). Some of this increase, however, is associated with the growth of away-from-home eating places, which discard significant amounts of fats used in frying foods, and thus may not accurately reflect intake (Putnam and Allshouse, 1993). But, it is unlikely that all of the increase would reflect waste. Because consumers claim to be eating less fats and oils, this upward trend suggests that consumers may not be very knowledgeable about the fat content of foods. Although they may be reducing their intake of visible fats (as in butter and margarine, and salad and cooking oils), consumers may be increasing their intake of foods with less-visible fat contents that are higher than they think (such as in the increased consumption of baked goods and fried foods in fast food service outlets).

The increasing contribution of vegetable fats and oils observed in figure 8 likely reflects consumer concern about the adverse effects of saturated fats on blood cholesterol. This same concern resulted in McDonald's and other fast food service establishments switching from using animal fats to an all-vegetable fat product for frying (Putnam and Allshouse, 1993). There is now some controversy about whether this switch benefited consumers, due to the presence of trans-fatty acids in McDonald's all-vegetable fat product for frying.[1]

[1]Research suggests that trans-fatty acids can raise blood cholesterol levels, and therefore increase the risk of coronary heart disease.

Figure 4
1990's cattle are leaner than 1940's cattle.

1940's steer



1990's steer

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Figure 5
Whole milk consumption declines, while lowfat and skim milk consumption increases.

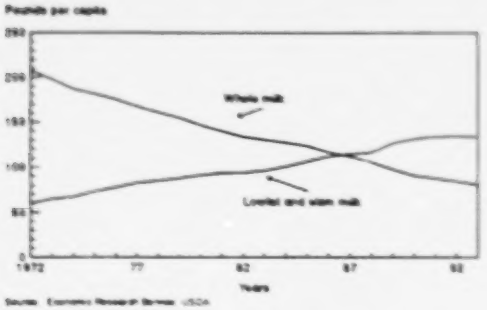


Figure 6
Cheese consumption has nearly doubled in the last 20 years.

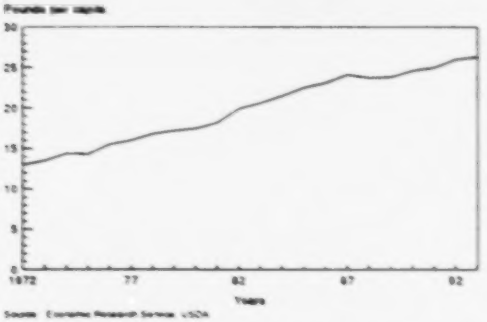


Figure 7
Consumption of eggs has declined dramatically.

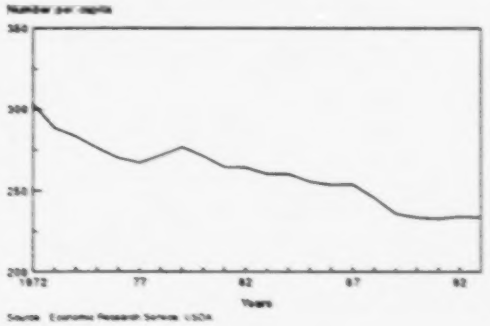
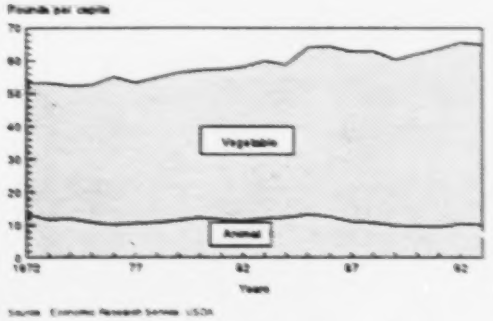


Figure 8
Despite consumer concerns, the availability of edible fats and oils has increased.



Although the availability of manufactured fats and oils continues to increase, HNIS estimates that the total fat content of the food supply has actually decreased since 1985 (Putnam and Allshouse, 1993). It may be that the reduced fat content of meats has offset some of the increases in manufactured fats and oils.

Flour and Cereal Products

Consumption of flour and cereal products continues to increase, spurred by a growing interest in healthy eating (fig. 9). For example, more than 1,500 new bakery products were launched in 1992 alone, many of them aimed at satisfying consumers' demand for "lite" (low-calorie), "low salt," "no-fat," "no-cholesterol," or "oat-bran-based" food items (*Prepared Foods*).

Fruits and Vegetables

Although the time-series data on fruits and vegetables is not very complete, the data available indicate that consumption of fruits and vegetables has increased roughly 10 percent in the past decade (fig. 10). Much of this growth, however, is due to an increase in frozen potato products, most of which are processed into frozen french fries (Putnam and Allshouse, 1993).

The relatively small increase in fruit and vegetable consumption is surprising, and may be partly due to a lack of consumer awareness of the number of recommended daily servings. Two out of three consumers think that just one or two servings a day is enough for good health; only 8 percent of American adults are aware that they should be eating five or more servings each day (Putnam, 1994). This upward trend is expected to accelerate in the near future, as knowledge continues to accumulate about the importance of fruits and vegetables to a healthy life.

Caloric Sweeteners

The amount of sweeteners used per capita--in soft drinks, candy, sweet baked goods, and processed foods--continues to grow (Putnam and Allshouse, 1993). In 1992, each American consumed, on average, more than one-third of a pound of added sweeteners a day. One factor behind this growth is the large increase of supermarkets with in-store bakeries.

The availability of specific sweeteners has changed strikingly in the past two decades, with sucrose being replaced by corn sweeteners, mainly high fructose corn syrup (HFCS) (fig. 11). This may become a nutritional concern, if new studies confirm preliminary evidence that diets high in fructose significantly increase blood lipid levels (Putnam, 1994).

These trends generally indicate that American eating habits are changing, with the trend toward healthier diets. But several intake problems persist, and conflicting trends in some products are working to slow the shift toward healthier diets. In many instances, consumers may be substituting foods with undesirable traits of which they may not be aware. For example, although Americans are eating more chicken, potatoes, and baked goods, much of it is fried chicken, french fries, and fatty baked goods (Liebman, 1990). A survey by the National Restaurant Association found that while 37 percent of the population is committed to ordering healthful dishes in restaurants, consumption of rich desserts has increased by 13 percent over the past 3 years (*Washington Post*, 1993).

A number of factors, such as the relative prices of foods, income, and changing population demographics, contribute to the observed changes in food consumption patterns. For example, part of the decline in per capita fluid milk consumption is attributed to declining numbers of teenage males, only partially offset by rising numbers of infants (Putnam and Allshouse, 1993).

Current Intake Levels and the Dietary Guidelines

Although the trends in food consumption indicate a switch towards a healthier diet, data from USDA's food intake surveys indicate that the average American diet still falls short of meeting the Dietary Guidelines. Intake of foods from the bread, cereal, rice, and pasta group, fruits and vegetables, and dairy products are, on average, about half the recommended levels.

The public health community is particularly concerned about the high fat intake of the American population. Although the proportion of total calories from fat has fallen from an average of 40 percent in 1977-78 to an average of 35 percent in 1989-90, this is still above the recommended 30 percent or less (Tippett and Goldman, 1994). Surveys show that while consumers do recognize the importance of limiting fat intake, only about one-fourth of them met the recommendation for fat intake in 1989-90 (Tippett and Goldman, 1994).

However, it is important to note that these are "average" values. Research indicates that eating habits vary widely across individuals, thus limiting use of national averages. Income, household size and type, race, age, sex, and education are significant explanatory variables of food intake patterns. And, research is beginning to focus on the role that nutrition knowledge and awareness of the diet-health link may have on food intake patterns.

Figure 9
Consumption of flour and cereal products is increasing.

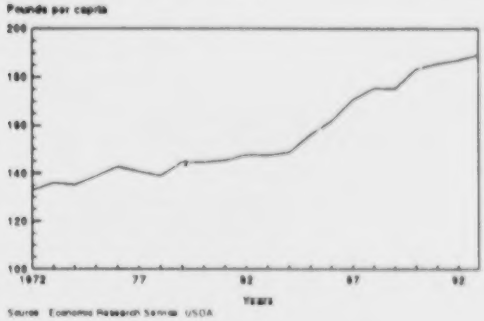


Figure 10
Consumption of fruits and vegetables is definitely on the rise.

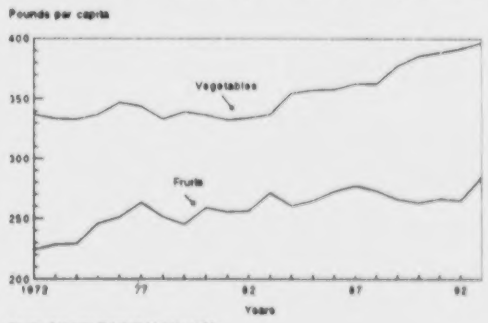
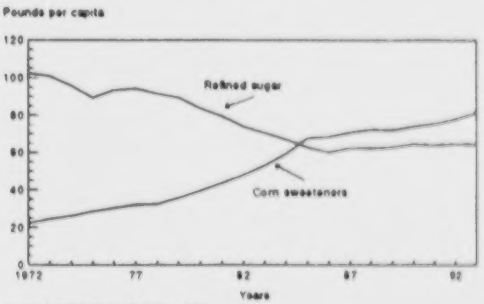


Figure 11
Corn sweetener consumption has overtaken consumption of refined sugar.



Changes in Food Consumption Patterns, 1977-88

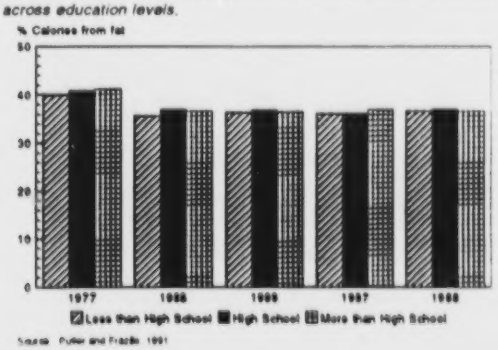
Until 1989, no available data sets simultaneously measured awareness of the link between diet and health and actual food intake behavior for the same individual. However, because awareness levels differ by education levels, researchers at the USDA used education levels as

a proxy for awareness of the diet-health relationship, and compared the nutrient intake of women aged 19-50 years, from surveys done in 1977-78 and in 1985 through 1988, after controlling for demographic variables (Putler and Frazão, 1991). The most startling finding was that average fat intake (measured as the percentage of calories from fat) fell fairly evenly across all education levels, from 41 percent in 1977 to 36 percent in 1985, and remained fairly constant thereafter (fig. 12). When analyzing sources of dietary fat, however, women with higher education levels made much greater changes in the relative importance of different food groups in providing dietary fat compared with women having less education.

These findings are attributed to a combination of two factors. First, between 1977 and 1985, women with higher education levels altered their fat intake patterns primarily by reducing their consumption of red meat and eggs (fig. 13). They also consumed more dairy products and mixed grain, fruit, and vegetable dishes, many of them high sources of hidden fat (such as cheese, pies, and pastries). Second, between 1977 and 1985, changes in meat-trimming practices and animal-breeding and other production practices combined to make red meat products leaner and to increase the availability of lower fat food substitutes. The net effect of these two factors was that women with higher education levels traded meat fat for other fat (mostly hidden fat in mixed grain, fruit, and vegetable dishes, and dairy fat), while total fat intake for all education levels declined.

Greater changes in food consumption patterns by women with higher education levels indicate that dietary information and education efforts have most directly affected the most-educated segments of society. This confirms recent research showing that public information and education programs on potential risks of dietary fat intake are more likely to influence the behavior of those who are best able to obtain and process the information. Consequently, public response to these programs is likely to be stronger in specific groups of the population, and practically nonexistent in other population groups.

Figure 12
There is little difference in the proportion of calories women consumed from fat across education levels.



Source: Putler and Frazão, 1991

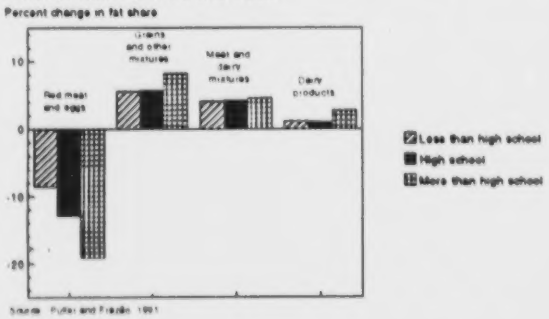
However, the lack of specificity in the nutrition information provided may have resulted in a substitution effect. Specifically, the incompleteness of the information resulted in consumers trading one kind of fat for another (that is, reducing fat intake from red meats, while increasing fat intake from mixed dishes and dairy products) without significantly altering total fat intake.

Finally, even though only the more highly educated segment of society appears to have directly responded to dietary information, these information programs may still have indirectly benefited all segments of society. More-educated and aware consumers' movement away from red meats and other high-fat products may have motivated meat producers to develop a leaner product, food retailers to more closely trim meat, and food manufacturers to develop lower fat alternatives to high-fat products (for example, nonfat and lowfat regular and frozen yogurt, reduced-fat cheeses, dairy desserts, and salad dressings, and nonfat baked goods). In turn, these production and reformulation practices enabled consumers with less education to lower their fat intake without having to make great changes in their food consumption patterns.

New survey data have recently become available that measure awareness of diet-disease relationships, knowledge about nutrients, and actual food intake behavior for the same individual (USDA's Continuing Survey of Food Intake by Individuals and the associated Diet and Health Knowledge Survey).

Research is beginning to focus on measuring the effects of nutrition awareness and knowledge on dietary behavior (*FoodReview*, 1994). As has been hypothesized before, and studies are now showing, it is not enough to simply tell people to cut down on their fat intake. People eat for a number of reasons, including psychological reasons. Taste, income, convenience, prices, longstanding habits, and cultural factors are also important.

Figure 13
Contribution of red meat and eggs to total fat intake of women declined between 1975 and 1985.



Source: Putler and Frazão, 1991

Among those who wish to change their dietary intakes, however, nutrition-related knowledge may be important. Preliminary analyses show that individuals with higher nutrition knowledge had higher intakes of fiber and were more likely to meet dietary recommendations for saturated fat and cholesterol (Smallwood and Blaylock, 1994; Frazão and Cleveland, 1994).

Recent research on how much Americans know about the fat content of foods commonly eaten suggests that many consumers have mistaken concepts about what foods are high in fat (Cremer and Kessler, 1992). Many shoppers do not know that lean ground beef is high in fat (Food Marketing Institute and *Prevention Magazine*, 1992); many think that white bread is high in fat (Cremer and Kessler, 1992); and many have difficulty identifying the degree of fat in some foods, such as pizza, cheese, and baked goods (U.S. Department of Health and Human Services, 1992).

The confusion stems in part from the complexity of the information. Consuming a balanced diet is not easy. Some people are good at making choices within a food group--for example, switching from whole milk to skim milk. It may be more difficult to make tradeoffs between food groups, such as estimating how much of a rich dessert they can eat if they delete the steak. The end result is that many give up the steak but overdo it on the rich dessert (Sugarman, 1991).

Consumers admit to being confused and uncertain about how to improve their diets, what foods to eat, and how to cut down on fat. However, without correct knowledge about the nutrient composition of the different foods that make up their diets, it may be difficult for consumers to change their nutrient intake levels.

In addition, despite the many lowfat and nonfat products available in the market, choosing a diet low in fat likely requires a number of changes in behavior and eating practices, as well as commitment to those changes. Attitudes towards diet, and knowledge about nutrition and the nutritional content of foods can affect motivation and ability to put dietary guidelines into practice. To choose a diet low in fat, saturated fat, and cholesterol, consumers must make many complex decisions about what foods to choose, how to prepare them, and how much of each individual food to eat in order to balance their desires for good health, taste, convenience, economy, and satisfaction.

The Food Sector Responds

Although the food industry at one time believed that nutrition would not sell, by the 1980's, nutrition had become a powerful selling force, illustrated by the growth in the number of new products introduced in response to nutrition concerns (Gallo, 1992). More than 4,500 nutrient content claims were made on foods introduced in 1992--nearly four times the number in 1988 (fig. 14). It is not yet clear why the number of nutrient content claims fell by nearly 50 percent in 1993--it is possible that some of the earlier claims no longer conformed with the new nutrition labeling regulations.

Figure 15 illustrates some interesting differences in nutrient content claims on new products introduced in 1992 and 1993. For example, 30 percent of dairy products claimed to be reduced fat, low-fat, or nonfat in 1992, but only 24 percent claimed so in 1993. Among breakfast cereals and bakery products, the proportions were similar for each year. However, for meat, poultry, and seafood, entrees, desserts, and fruits and vegetables, 1993 claims for reduced fat, low-fat, or nonfat products were nearly half those in 1992.

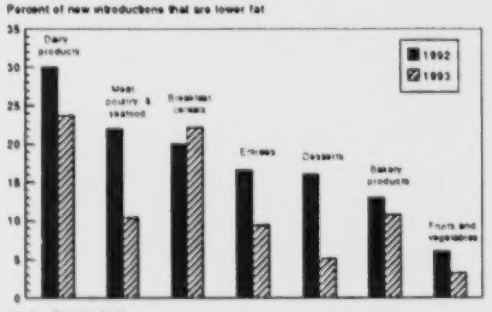
Among the 13 food categories monitored, bakery products, prepared entrees, and processed and fresh meat/poultry/seafood were popular categories for new reduced fat, low-fat, or nonfat products in 1992, with more than 100 of such products introduced in each of

Figure 14
Food manufacturers have discovered that "nutrition" sells

Product claim	1988	1990	1991	1992	1993
			Number		
Reduced or low calorie	475	1,165	1,214	1,130	609
Reduced or low fat	275	1,024	1,158	1,257	647
Low or no cholesterol	126	594	711	677	287
Reduced or low salt	252	517	572	530	242
Reduced or low sugar	52	131	468	492	473
Added or high fiber	56	94	106	137	51
Added or high calcium	8	20	15	61	14

Note: Data contain some double counting because new products may carry more than one health claim.
Source: Prepared Foods.

Figure 15
Dairy products and breakfast cereals were the main food groups introducing lower fat products in 1993.



these three categories. In 1993, only dairy and bakery products had more than 100 reduced fat, low-fat, or nonfat products introduced in each category (*Prepared Foods*).

One obstacle to offering foods lower in fat is that reducing the fat often means sacrificing taste. Fat adds flavor to many foods, such as meats and dairy products. Some manufacturers have been able to offer a satisfactory alternative by reformulating their products using nonfat ingredients. For example, Kraft General Foods, owners of Entenmann's Inc., a bakery products firm, applies new processing techniques to produce fat-free baked goods using skim milk and egg whites. Other manufacturers have reduced the fat content of fried products by par-frying to develop crispness and color, and finishing in an oven to minimize fat absorption. Others have incorporated film-forming cellulose into their products to reduce fat absorption and retain moisture. Still others have devoted considerable resources to develop fat substitutes that allow the lower fat products to taste and function like traditional high-fat foods (Morrison, 1992).

Continued research and product development that alter the nutritional composition of foods will likely be an important contribution to improving nutrient intake levels in the United States. Although Americans are making some dietary changes, they enjoy the taste of high-fat foods and do not seem willing to give them all up. If food companies can develop lower fat products that taste like traditional high-fat foods, and provide consumers with acceptable low-fat substitutes, the food industry can help consumers to eat less fat without having to greatly change their eating habits.

For example, a market research firm that has been tracking Americans' eating habits for the past 13 years discovered that the reason that people are eating healthier is not because of large changes in behavior. Actually, little difference was found in the top 10 foods people ate for lunch and dinner in 1982 and in 1992. The top food consumed in both years was a ham sandwich. The difference was that, in 1992, the ham sandwich was more likely to be made with turkey ham, lite mayonnaise, and whole-wheat bread--small behavior changes made possible due to new products developed by the food industry (Sugarman, 1993).

The success of new research and technology in improving the nutritional composition of Americans' diets, however, depends on a number of factors. First, Federal regulators must approve the safety of novel ingredients and their use in food, a process that can often be quite lengthy. Procter and Gamble (P&G) has been working with FDA since 1987 to obtain approval for olestra, an undigestible fat substitute. In an attempt to speed up approval, P&G narrowed its initial petition seeking general use of olestra in shortenings and oils to use in just fried snack foods (Morrison, 1992).

Consumers' perceptions of safety are also important. Negative consumer reaction could jeopardize sales of food as well as other products made by the food company (Morrison, 1992). Two examples are whether consumer concern over pesticide residues, particularly as they may affect children, will present a barrier to greater consumption of fruits and vegetables, and whether controversial publicity surrounding recombinant bovine somatotropin (rBST) will hurt consumption of dairy products now that rBST has been approved. Finally, price competitiveness and marketing strategies also play a major role in whether new products and ingredients will be successful in the market (Morrison, 1992).

Grocers have also responded to consumers' nutrition concerns and are giving more space and attention to the fresh produce section. Today's medium-sized supermarket carries more than 300 produce items, compared with 150 in 1980 and 64 in 1970. Large supermarkets average 400 items (Putnam, 1994). To reduce the time requirement of preparing fresh fruits and vegetables, the produce department has also introduced a host of new products and services. Cut and peeled carrots, celery, broccoli, cauliflower, and salad mixes, peeled and cored pineapples, citrus, and melons--a whole variety of fresh products--are now being washed, prepared, and packaged so consumers can pick them up at their retail outlet, open the package, and start eating (Putnam, 1994).

Fast food places and restaurants have also increased their availability of fruits and vegetables. Restaurant salad bars, introduced in the mid- and late 1970's, have become so popular that major hamburger chains and supermarkets eventually jumped on the bandwagon. Burger King started with salad bars in 1983, but switched in 1988 to prepackaged salads to accommodate the increasing drive-thru traffic. McDonald's began offering prepackaged salads in 1986. Most supermarket chains added salad bars during 1982-84. Most now offer a wide array of prepared salads (Putnam, 1994).

Nutrition education is another area in which the food sector has become actively involved in response to consumers' nutrition concerns. An example of such a program is "5 a Day for Better Health," an active partnership between the National Cancer Institute (NCI), the produce industry, and the health community, aimed at increasing consumption of fruits and vegetables. This program provides an unprecedented opportunity for the food industry to mount a cooperative generic promotion

with the support of a leading health authority. As of June 1992, more than 250 retailers had signed license agreements to participate in the 5 a Day program, representing more than 30,000 supermarket chain and independent grocery stores. In addition, some 200 merchandisers and suppliers were licensed. This section of the industry includes growers, shippers, packers, commodity boards, manufacturers, and other nonretailers. Overall, the produce industry spent $18 million in 1992 on 5 a Day promotion. Total spending by the produce industry and NCI over the life of the 10-year program is likely to top $200 million (Putnam, 1994).

Finally, food advertising and labeling can be powerful mechanisms for educating consumers and reaching groups of consumers that are not well reached by government and general information sources. Whereas advertising and label claims can provide consumers with more information about nutrition, they can also be misused, as manufacturers fight to gain a competitive edge for their products. Two examples of how claims can influence consumer information and behavior are discussed below.

Research suggests that after information about the link between fiber and cancer became available on cereal boxes, sales of high-fiber cereals increased 37 percent within 1 year. As consumers' awareness increased, the food industry responded by introducing more high-fiber cereals. Increases in intake of high-fiber cereals were largest among nonwhite, low-educated women, suggesting that advertising was more effective at exposing the fiber information to consumers with limited access to scientific evidence and information put out by the Government (Ippolito and Mathios, 1989). Research also suggests that although Americans appear to lack an understanding of the fiber content of foods, they tend to be aware of the high fiber content of bran flakes, which is attributed to the abundant advertising of high-fiber cereals (Cremer and Kessler, 1992).

On the other hand, claims such as "low cholesterol" or "no cholesterol," which have been widely used in recent years as a marketing tool, have led some consumers to lose confidence in the claim. Part of the problem was that consumers often made wrong inferences about the nutritional content of the food, based on the partial information the claim provided. For example, consumers often assumed that a product labeled "no cholesterol" was also low in fat, or that a product labeled "95% fat free" was low in fat. (It need not be, because the claim "95% fat free" is based on product weight. A cup of water with one tablespoon of butter may be 95% fat free, by weight, but it still provides the same 12 grams of fat as one tablespoon of butter.)

The Government Responds

To assist consumers in choosing a healthful diet, and eliminate some of the confusion in labeling, the Government passed new nutrition labeling regulations (U.S. Department of Agriculture, 1993; U.S. Department of Health and Human Services, 1993). Both the food industry and consumer groups supported the Government's efforts, although each group has criticized some of the specifics of the new regulations.

Nutrition labeling is regulated by two different agencies. The USDA regulates labels on meat and poultry products, and the FDA regulates the labels on all other food products. (A third agency, the Federal Trade Commission, regulates advertising.) Both FDA and USDA have allowed food packages to provide nutrition labeling on a voluntary basis (except when a nutrition claim is made or when a nutrient is added to the food). Thus, as of 1992, consumers faced many products that did not provide a nutrition label; it is estimated that only 4 percent of meat and poultry products and 40 percent of nonmeat and nonpoultry products contained nutrition information (U.S. Department of Agriculture, 1993; U.S. Department of Health and Human Services, 1993). When provided, the nutrition label had to follow a prescribed format, but contained information of little use to the consumer. The prescribed format, designed in 1973, focused on the nutrients of concern at that time (such as the B-vitamins), and not on the nutrients of health concern today (such as cholesterol, saturated fat, and fiber). Further, the information was often confusing--such as when a label advertised "no cholesterol," which consumers often mistook to mean "low in fat."

In November 1990, the U.S. Congress passed the Nutrition Labeling and Education Act (NLEA), making nutrition labeling mandatory for most nonmeat and nonpoultry products. Regulations issued in January 1993 made nutrition labeling mandatory for most processed products as of May 1994 (U.S. Department of Agriculture, 1993; U.S. Department of Health and Human Services, 1993). The regulations change the required nutrients, define nutrient content claims (such as "light," "reduced," "low," and "lean"), make serving sizes more uniform across product lines, and list permissible health claims for nonmeat and nonpoultry products. Raw fruits and vegetables, raw seafood, and raw meat and poultry products fall under a voluntary nutrition labeling regulation, which could become mandatory if compliance is low. The regulations provide some exemptions, such as for small businesses and foods in small packages.

The nutrition labeling regulations were based on the premise that consumers will use the new labels to change

their food choices and, in particular, eat less fat. Using a model that estimates the declines in mortality from coronary heart disease and cancer associated with reductions in fat intake, the Government estimated that savings in health benefits would surpass $6 billion over a 20-year period (U.S. Department of Agriculture, 1993; U.S. Department of Health and Human Services, 1993).

There is much controversy, however, about the benefits that consumers will actually derive from mandatory nutrition labeling. Critics question the assumptions that consumers will (1) read the labels, (2) change consumption and nutrient intake, and (3) experience fewer chronic diseases. There are no hard data to support these assumptions, although a supermarket experiment with shelf-labeling showed changes in food purchases (Schucker and others, 1992).

The benefits above are conservative, in that they do not include (1) health savings associated with the reduced number of cases of other diet-related diseases, (2) any effects the NLEA's nutrition education efforts may have on label use and nutrient intake, and (3) benefits by consumers who do not read nutrition labels but who may benefit if manufacturers reformulate their products to improve their nutritional value. In addition, the estimates do not take into account nonconsumption benefits of mandatory nutrition labeling, such as increased consumer confidence in the quality of food and in the food industry.

Costs of the nutrition labeling regulations were estimated at $1.6-2.6 billion over a 20-year period (U.S. Department of Agriculture, 1993; U.S. Department of Health and Human Services, 1993). Most of the costs were attributable to (1) analytical costs of determining the nutrient content of the food product, and (2) costs of printing new labels. To minimize the burden on the food industry, manufacturers may use nutrient databases, rather than chemical analyses, to compute the nutrient content of foods. Also, the food industry was given an additional extension to use up old labels and then develop new ones.

How well consumers understand and apply the information on the new labels to choose a healthful diet will strongly depend on the success of public and private nutrition education activities. Timely assessment of the effects on consumer behavior and adequate oversight of implementation will also be important.

The mandatory nutrition labeling is expected to give the food industry incentive to reformulate many of their products to improve their nutritional profile, further aiding consumers to improve their nutrient intake.

Likely Impacts on Agriculture

If consumers use the new nutrition labels and make large shifts in their demand for basic commodities as they move toward healthier diets, how would that affect U.S. and foreign agriculture?

If demand moved in the direction of meeting the Dietary Guidelines, the volume and mix of products produced would have to change, along with how and where they are produced, and their price (O'Brien, 1994). The following sections describe potential farm-level effects.

Fruits and Vegetables

Meeting the increased demand for fruits and vegetables associated with healthier diets could have far-reaching implications, given the distinctly different nature of horticultural operations compared with the grain-oilseed-livestock operations that currently dominate U.S. agriculture. Fruit and vegetable production tends to be highly intensive, using a disproportionately large share of the sector's capital, labor, and purchased inputs such as fertilizers and pesticides. Production is also heavily concentrated in areas such as Florida, California, and Michigan. Thus, responding to increased demand could change the regional composition of U.S. agriculture. As improved refrigeration and transportation enable expanded supply sources, much of the increased demand could come from imports, particularly during "off" seasons for tropical products with limited or no U.S. production possibilities, and for the most labor-intensive products.

Whether from domestic or foreign supply, an increased demand for fruits and vegetables might be associated with a troubling increase in agrochemical use that could in turn raise concerns about food and environmental safety. While use of fertilizers and pesticides varies widely by crop and location, chemical use, particularly pesticide use, is typically many times greater per acre and per pound of product harvested for fruits and vegetables than for grains and oilseeds (fig. 16). Production studies suggest that

Figure 16
Heavy use of fertilizers and agrochemicals affects production of fruits and vegetables

Commodity	Fertilizer	Agrochemicals
	Pounds per acre	
Field crops		
Corn	229	3
Wheat	77	2
Soybeans	32	1
Specialty crops		
Apples	82	61
Oranges	460	53
All vegetables	371	44

Note: Fertilizers total includes nitrogen, phosphates, and potash. The agrochemicals total includes herbicides, insecticides, and fungicides. The most commonly used chemicals were paraquat, atrazine, glyphosate, toluclor, cynazine, EPTC, MCPA, mevinphos, methazin, pendimethalin, vetsulfa, and triflurain.

Source: O'Brien, 1994

chemical pest control plays a critical part in keeping American horticulture profitable, supplies large, and prices low.

Many consumers rank agrochemical use as the number one food safety concern (Food Marketing Institute, 1993). The 1991 residue monitoring report by the FDA found that less than 1 percent of the fruits sampled and less than 2 percent of the vegetables sampled contained residues in excess of FDA's tolerance limits, but more than 40 percent of the fruits sampled and 33 percent of the vegetables sampled contained detectable pesticide residues (Food and Drug Administration, 1992). As a result of consumer concerns, a number of growers and retailers have initiated their own pesticide residue testing program (Cook, 1991; Kaufman and Newton, 1990; Van Ravenswaay, 1989). In addition, the Federal Government is reviewing registered pesticides for their safety.

Growing consumer willingness to pay premiums and efforts to legislate agrochemical use at the State and Federal levels is generating farmer interest in alternative production methods. A recent survey found that fruit and vegetable producers used more than 30 different practices in addition to using pesticides to control pests (O'Brien, 1994). These practices involve mixing pesticide use with other conventional pest-control methods (such as crop rotation and releasing beneficial insects that prey on insect pests) and unconventional methods (such as using pheromone traps to disrupt mating). Interest is also growing in genetic engineering to develop pest-resistant crops and in organic production.

Grains and Cereals

Adjustments in food grains would be appreciably smaller but still significant (O'Brien, 1993). The sector already has the physical capacity to expand grain production to meet greater food demand. Bringing into use the wheat and rice land currently idled under USDA's supply management programs would push supplies above the midpoint of the recommended range. Moreover, expanding output would do little to affect the regional composition or the nature of agricultural production.

Dairy

Adjustments in the dairy sector would be marked and would extend from farmers through to consumers (O'Brien, 1993). The farm sector would be called on to increase output more than a third, adding to pressure on producers to accelerate adoption of the latest breeding and feeding technologies despite consumer concerns about the safety of some of these technologies. However, the composition of the milk produced and marketed would have to be quite different, with producers accelerating the move away from butter fat toward nonfat solids that has been underway for more than a decade.

Adjustments would also be marked beyond the farm gate, where milk processing and manufacturing decisions are made. Convincing Americans to eat more dairy products, but a lower fat mix of products, will depend on expanding the range of products available in the market and boosting their consumer appeal.

Feed-Livestock Adjustments

Adjustments in the feed-livestock complex would be farther reaching than the small changes in the broad meat category would suggest (O'Brien, 1993). Meeting the recommendations to "consume more lean meats" would involve accelerating the trends toward leaner red meat and more fish and poultry. This would likely generate a marked change in livestock operations and a significant downsizing of the feed industry.

Link Between Food Policy and Dietary Change

Strengthening the link between food policy and dietary change could also facilitate transition. Shifting direct USDA purchases for the food assistance programs (such as school lunch programs) to reinforce dietary recommendations rather than disposing of surpluses (such as cheese, butter, red meats) would ease the transition by sending farmers consistent production signals. Realigning marketing policies--such as revamping grades and standards to facilitate better transmittal of market signals between consumers and producers--would also accelerate the adjustment.

Conclusions

The growing evidence of the link between diet and health has not been lost among American consumers. As consumers have become more aware of this relationship, they have made some changes to their diets, and are eating less red meat and fewer eggs, and are drinking less whole milk.

There is still considerable room for improvement to meet Federal food guidance recommendations. Consumption of grains and cereals and fruits and vegetables is much lower than the recommended amounts, while intake of fat and saturated fat remains above the recommended levels. Consumers admit to being confused about the conflicting information they receive. For example, first they learn that margarine is better for you than butter, then they learn that margarine contains high levels of trans-fatty acids that may actually increase blood cholesterol levels (*Nutrition Week*, 1993). It is not surprising that many

consumers seem to have stopped worrying about nutrition. In a 1993 survey, concern about the nutritional content of the diet was mentioned by 54 percent of the respondents, compared with 64 percent in 1992 (Food Marketing Institute, 1993).

Among consumers who desire to improve their diets, many claim they lack the information to do so. Research shows that many of the changes Americans have made in their food choices end up cancelling each other out. New nutrition labeling regulations, and their concomitant nutrition education activities, may be instrumental in helping consumers change food consumption behavior.

The food sector has actively responded to consumer demands for more nutritious foods, although at times its efforts have confused consumers. However, the food sector remains an important participant in the move toward healthier diets, with its required changes in the volume, mix, and nutritional composition of the products marketed. Technological advances in food production and processing have given the food industry new tools--such as protein- or carbohydrate-based fat replacers--that are likely to accelerate the introduction of tasty reduced-fat foods.

The food sector also faces an enormous challenge in complying with the new nutrition labeling regulations, while still using nutrition as a marketing and advertising tool. Finally, the food sector is an important partner with the Government and other health institutions in the development and dissemination of nutrition information to educate consumers as to how to improve their dietary intakes.

Changes in what, where, and how food products are produced present unlimited opportunities for producers and food manufacturers who can identify, respond to, or create new consumer food desires that are not being met by the domestic food sector.

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Appendix: Main Sources of Information

USDA's food intake surveys. These surveys collect information on what individuals say they eat over a period of 1-3 consecutive days.

USDA had conducted the Nationwide Food Consumption Survey (NFCS) approximately every 10 years since 1936. The survey collected information on demographics and household food use for a 1-week period from a nationally representative sample of households. In 1965-66, the NFCS began collecting individual food intake data for all foods consumed by individuals over a 1-day period. In 1977-78 and in 1987-88, information was collected on individual food intake for up to 3 consecutive days.

Realizing that 10 years was too long a time between surveys, the USDA began a series of smaller surveys in 1985, the Continuing Surveys of Food Intake by Individuals (CSFII). These surveys were to be conducted annually, focusing on specific subpopulation groups (for example, 1985 and 1986 focused on women aged 19-50 years and their preschool children). In 1989-91, the USDA launched the second series of CSFII, covering all age groups. These surveys collected data on all the foods consumed by individual members of the household over 1-3 consecutive days. The third series of CSFII surveys covers 1994-96, and includes collection of food intake over 2 nonconsecutive days by individuals of all ages.

In 1989, a telephone follow-up survey to the CSFII, the Diet and Health Knowledge Survey (DHKS) was initiated to collect information on the nutrition knowledge and attitudes of the main meal planner/preparer of the household. The 1989-91 CSFII and the 1989-91 DHKS were designed so that their respondents' information could be linked, for the first time providing researchers data on nutrition knowledge and attitudes and food consumption for the same individual.

A common criticism of individual food intake surveys is that individuals may either omit items or misjudge the quanitities consumed. This is reflected in experiments demonstrating that "average" people eating the "average" diet identified in the surveys experience significant weight loss, suggesting an understatement bias (U.S. Department of Agriculgure, Agricultural Research Service, 1992; *Food Chemical News*, 1993).

USDA's Food Consumption, Prices, and Expenditures time series. This series estimates the amount of food that enters the marketing channels and is, therefore, available for human consumption. The data are useful as an indicator of food availability at the national level. Per capita food disappearance is calculated by estimating the amount of a product available for food use (production + imports - exports - feed - seeds - other nonfood uses - stock changes) and dividing it by population. The data take into account some losses that occur in food processing, preparation, and plate waste, but is not able to account for all nonfood uses. The numbers therefore represent an upper boundary of the amount individuals actually eat (Putnam and Allshouse, 1993). However, the trends captured in the time series should reflect the directions of change in food consumption patterns.

The data are available for large product groups and cannot pick up changes in product characteristics that can be particularly important in evaluating their impact on nutrition. For example, although the data capture changes that have been occurring in meat trimming practices, they do not capture the lower fat content in meats due to changes in breeding practices over time. Similarly, the data do not capture changes in the average amount of fat in salad dressings, spreads, and cheese, due to the use of fat substitutes, the incorporation of air into spreads, and new technologies. These changes tend to move nutrient intakes toward healthier levels, but are not captured by the food disappearance data.

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